

Emission and Air Quality Trends Review 1999-2011

New Jersey

July 2013

Project Objective

- ▣ To develop and present publicly available information on trends in emissions and ambient air quality in the U.S. since 1999 in easy to understand visual and tabular formats

Emission Trends

- ❑ Study Team collected and processed U.S. EPA emission inventories for years within the study period of interest (1999-2011)

- ❑ By pollutant and source category
 - electric utility coal fuel combustion
 - mobile sources
 - industrial fuel combustion & industrial processes
 - all other

Emissions Data Summary

- Data Obtained from EPA National Emission Inventory (NEI) and Trends Websites
 - EPA's Trends reports and emission comparisons include interpolations of all categories between key years (1999, 2002, 2005, 2008, 2011) at county-pollutant level
 - Represented Pollutants: VOC, NO_x, SO₂, and PM_{2.5}
- Project Improvement
 - The Study Team augmented above data with year specific CEM emissions (2002 through 2011)

Emission Changes

- ❑ The following slides also include the tonnage-based emissions change from 1999 to 2011 for each pollutant
- ❑ Negative values indicate decrease in emissions, positive values indicate an increase

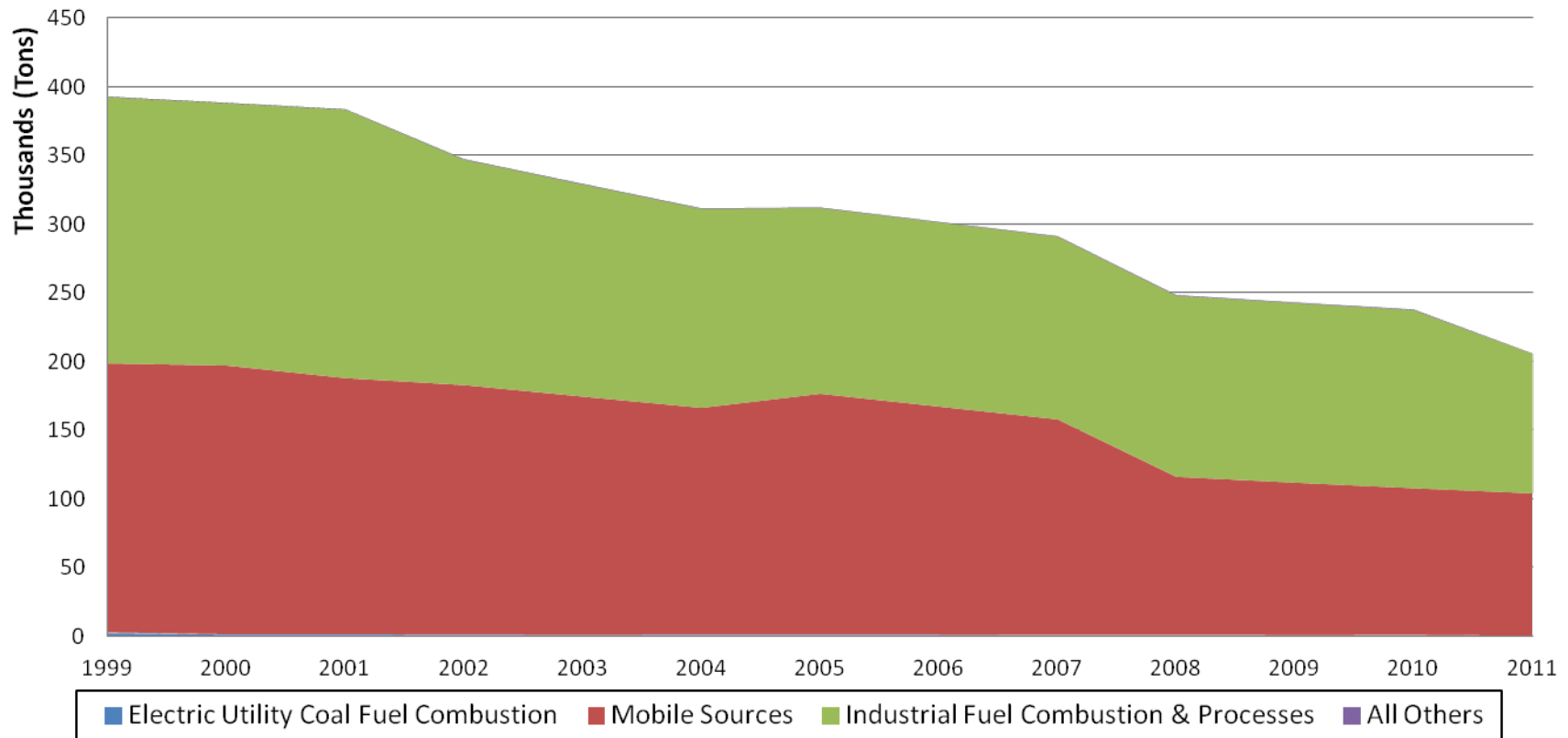
New Jersey Emission Trends (VOC)

Source Category	Annual Emissions (Tons)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	2,314	1,023	660	821	711	574	630	427	531	29
Mobile Sources	196,215	186,731	173,642	175,531	166,319	157,106	115,215	111,107	106,999	103,765
Industrial Fuel Combustion & Processes	194,015	195,658	154,690	135,431	134,315	133,200	132,087	130,971	129,856	101,622
All Others	335	340	397	374	369	379	461	429	456	222
Total	392,879	383,752	329,388	312,156	301,714	291,260	248,393	242,935	237,842	205,639

Source Category	Annual Emissions Change (Percent since 1999)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	0%	-56%	-71%	-65%	-69%	-75%	-73%	-82%	-77%	-99%
Mobile Sources	0%	-5%	-12%	-11%	-15%	-20%	-41%	-43%	-45%	-47%
Industrial Fuel Combustion & Processes	0%	1%	-20%	-30%	-31%	-31%	-32%	-32%	-33%	-48%
All Others	0%	1%	18%	11%	10%	13%	37%	28%	36%	-34%
Total	0%	-2%	-16%	-21%	-23%	-26%	-37%	-38%	-39%	-48%

New Jersey Emission Trends (VOC)

**Major Source Category Summary
Annual VOC Emissions**



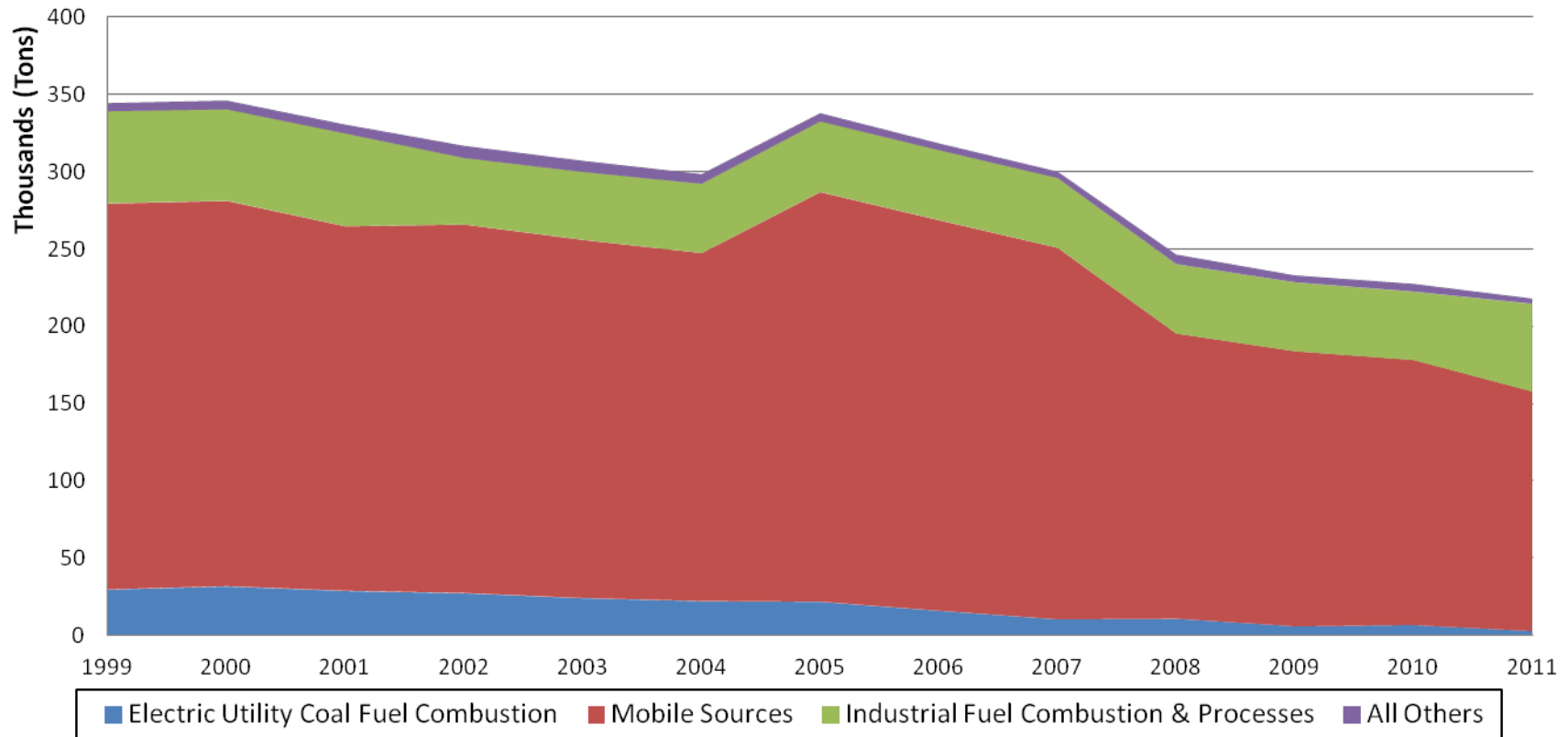
New Jersey Emission Trends (NO_x)

Source Category	Annual Emissions (Tons)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	29,450	28,561	23,834	21,479	15,611	10,042	10,425	5,492	6,320	2,381
Mobile Sources	250,062	236,127	232,151	265,414	253,112	240,811	184,897	178,407	171,917	155,447
Industrial Fuel Combustion & Processes	59,812	60,189	44,001	45,822	45,370	45,147	44,991	44,582	44,208	56,767
All Others	5,332	5,770	7,192	5,392	4,392	4,188	6,095	4,429	4,973	3,260
Total	344,656	330,648	307,178	338,107	318,485	300,188	246,408	232,910	227,419	217,854

Source Category	Annual Emissions Change (Percent since 1999)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	0%	-3%	-19%	-27%	-47%	-66%	-65%	-81%	-79%	-92%
Mobile Sources	0%	-6%	-7%	6%	1%	-4%	-26%	-29%	-31%	-38%
Industrial Fuel Combustion & Processes	0%	1%	-26%	-23%	-24%	-25%	-25%	-25%	-26%	-5%
All Others	0%	8%	35%	1%	-18%	-21%	14%	-17%	-7%	-39%
Total	0%	-4%	-11%	-2%	-8%	-13%	-29%	-32%	-34%	-37%

New Jersey Emission Trends (NO_x)

**Major Source Category Summary
Annual NO_x Emissions**



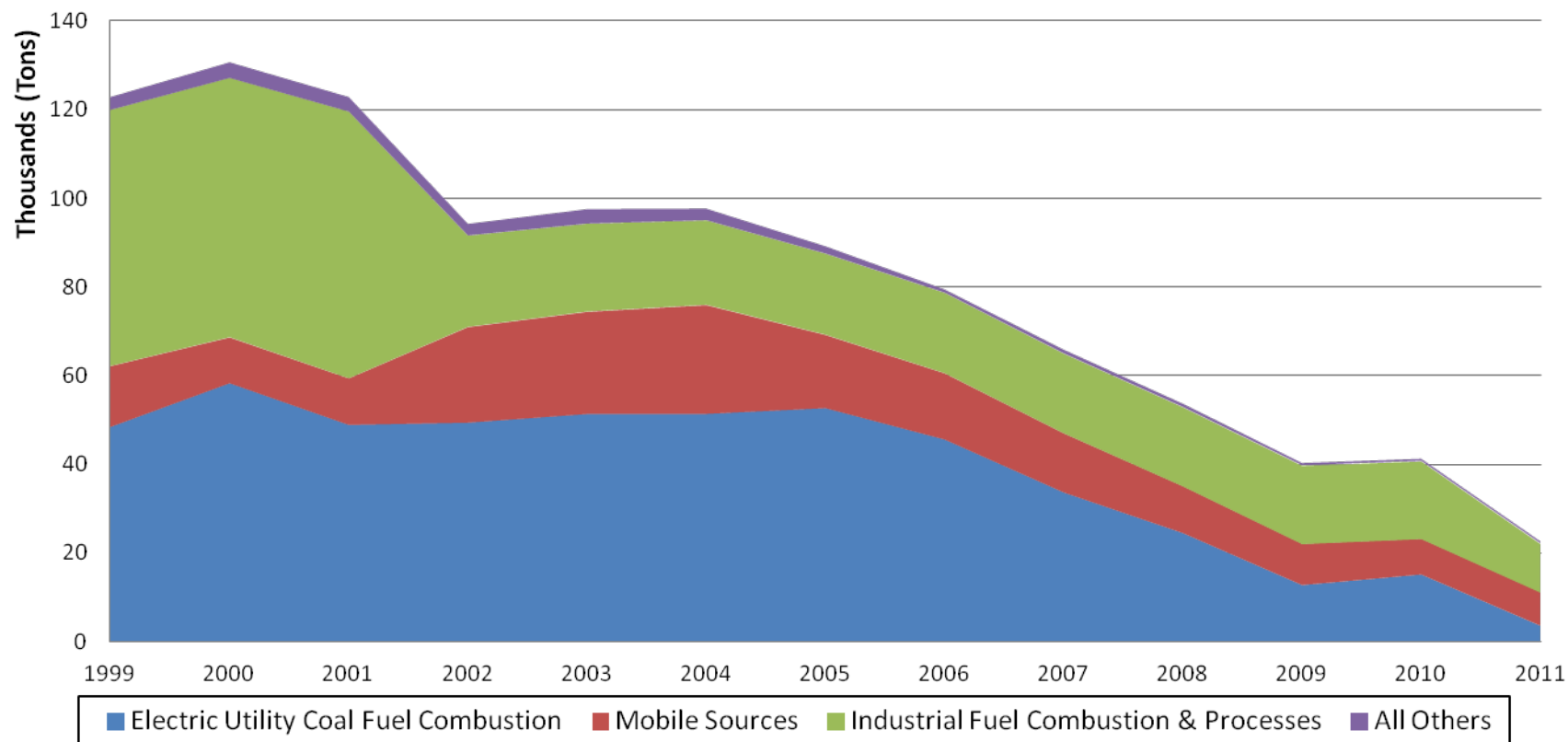
New Jersey Emission Trends (SO₂)

Source Category	Annual Emissions (Tons)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	48,437	48,901	51,382	52,717	45,610	33,622	24,430	12,667	15,063	3,471
Mobile Sources	13,773	10,539	23,117	16,559	14,981	13,404	10,634	9,376	8,117	7,636
Industrial Fuel Combustion & Processes	57,771	60,166	19,807	18,261	18,112	17,966	17,819	17,671	17,524	10,972
All Others	2,889	3,270	3,246	1,614	697	793	685	470	436	411
Total	122,869	122,876	97,552	89,151	79,401	65,786	53,568	40,184	41,141	22,490

Source Category	Annual Emissions Change (Percent since 1999)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	0%	1%	6%	9%	-6%	-31%	-50%	-74%	-69%	-93%
Mobile Sources	0%	-23%	68%	20%	9%	-3%	-23%	-32%	-41%	-45%
Industrial Fuel Combustion & Processes	0%	4%	-66%	-68%	-69%	-69%	-69%	-69%	-70%	-81%
All Others	0%	13%	12%	-44%	-76%	-73%	-76%	-84%	-85%	-86%
Total	0%	0%	-21%	-27%	-35%	-46%	-56%	-67%	-67%	-82%

New Jersey Emission Trends (SO₂)

**Major Source Category Summary
Annual SO₂ Emissions**



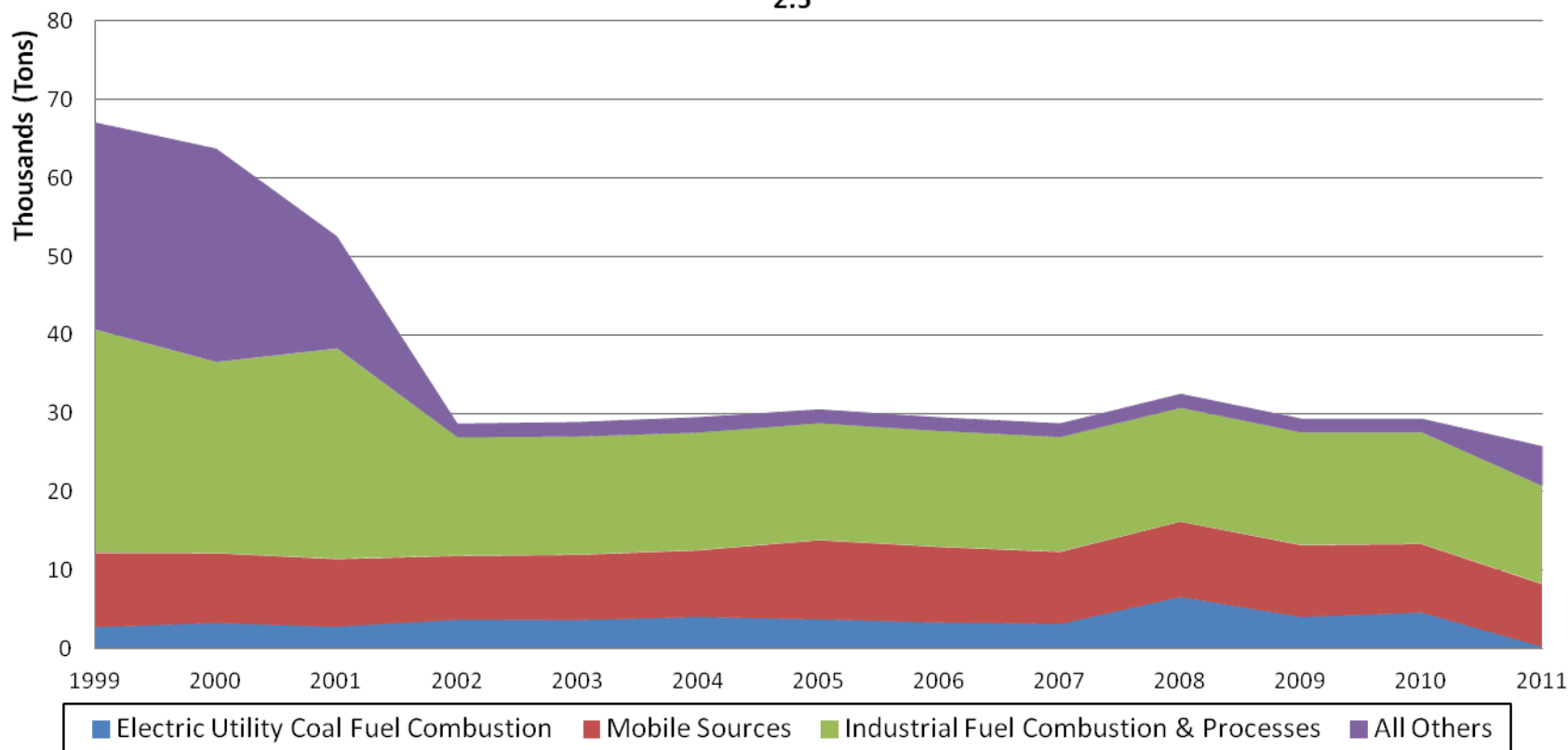
New Jersey Emission Trends (PM_{2.5})

Source Category	Annual Emissions (Tons)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	2,750	2,796	3,657	3,741	3,330	3,135	6,588	4,028	4,592	245
Mobile Sources	9,447	8,621	8,297	10,067	9,629	9,190	9,590	9,159	8,728	7,977
Industrial Fuel Combustion & Processes	28,503	26,887	15,114	14,959	14,812	14,680	14,546	14,403	14,264	12,535
All Others	26,417	14,318	1,860	1,768	1,750	1,745	1,804	1,772	1,773	5,079
Total	67,117	52,622	28,928	30,536	29,522	28,750	32,528	29,362	29,357	25,837

Source Category	Annual Emissions Change (Percent since 1999)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	0%	2%	33%	36%	21%	14%	140%	46%	67%	-91%
Mobile Sources	0%	-9%	-12%	7%	2%	-3%	2%	-3%	-8%	-16%
Industrial Fuel Combustion & Processes	0%	-6%	-47%	-48%	-48%	-48%	-49%	-49%	-50%	-56%
All Others	0%	-46%	-93%	-93%	-93%	-93%	-93%	-93%	-93%	-81%
Total	0%	-22%	-57%	-55%	-56%	-57%	-52%	-56%	-56%	-62%

New Jersey Emission Trends (PM_{2.5})

Major Source Category Summary
Annual PM_{2.5} Emissions



Emission Trends Summary

- All pollutants have decreased since 1999 in aggregate across New Jersey
- NO_x and SO₂ from Electric Utility Fuel Combustion sources show significant decrease over time as a result of Acid Rain Program, NO_x Budget Trading Program and CAIR control implementation
- Onroad emission step increase seen between 2004 and 2005 is the result of EPA's method change and MOVES model integration for estimating onroad mobile source emissions

Air Quality Design Values

□ Ozone

- Annual 4th highest daily maximum 8-hour average averaged over three consecutive years
- Current standard = 0.075 ppm

□ PM_{2.5} Annual

- Annual arithmetic mean of quarterly means averaged over three consecutive years
- Current standard = 12 ug/m³

□ PM_{2.5} 24-Hour

- Annual 98th percentile of daily averages averaged over three consecutive years
- Current standard = 35 ug/m³

State-Wide Design Value (DV) Trends

- ❑ Trends in state-wide maximum DV and average DV
 - Max DV: Maximum DVs over all valid trend monitoring sites in the state in each overlapping three year period
 - Average DV: Average of DVs over all valid trend monitoring sites in the state in each overlapping three year period
- ❑ Compute linear trend via least-squares regression

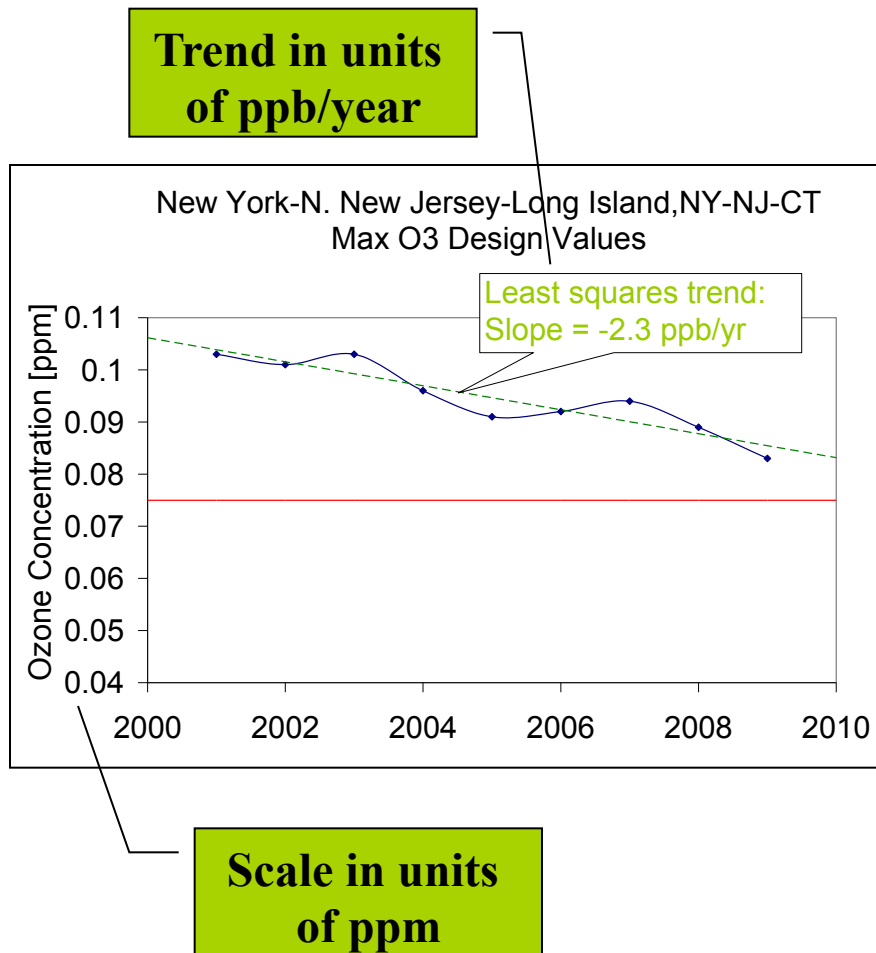
Data Handling Procedures

- O₃ design value (DV) for each overlapping three-year period starting with 1999-2001 and ending with 2009-2011
 - DV calculated using annual 4th highest daily max 8-hr averages and percent of valid observations, based on EPA data handling conventions
 - Data associated with exceptional events that have received EPA concurrence are omitted
 - Selection of trend sites require valid DV in 9 out of 11 three-year periods between 1999 and 2011
 - Identification of nonattainment areas is with respect to the 2008 8-hour standard only

Data Handling Procedures

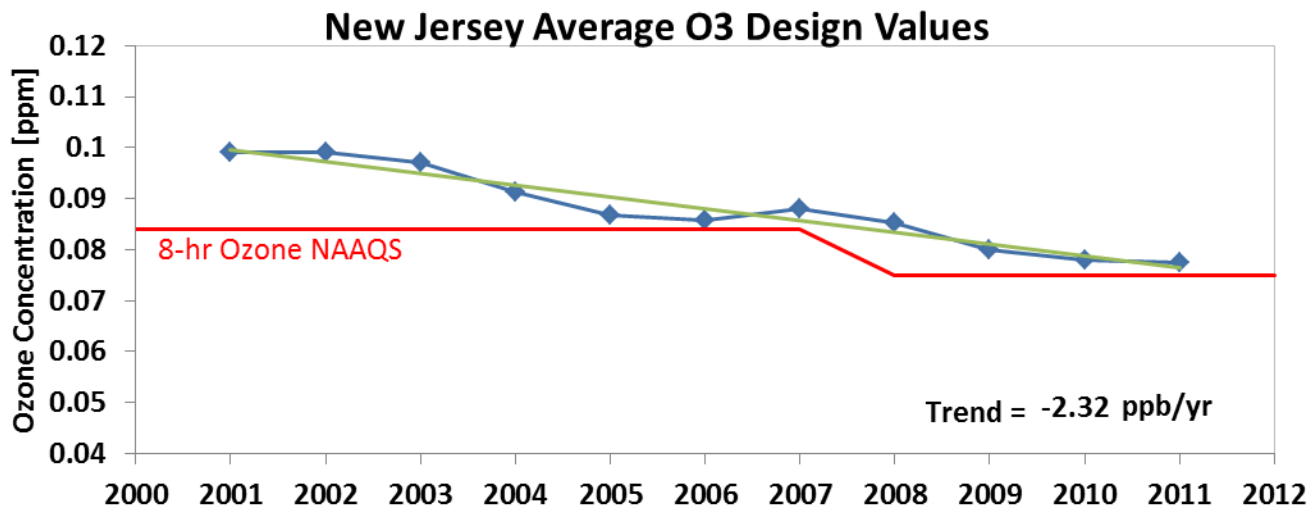
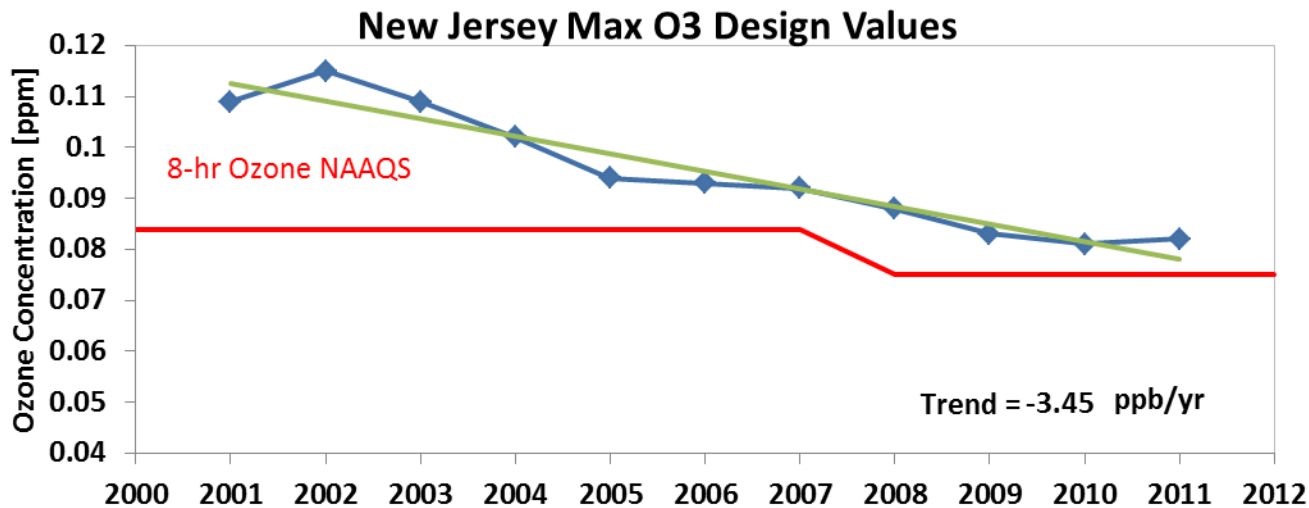
- ❑ Annual $\text{PM}_{2.5}$ DV and 24-hr $\text{PM}_{2.5}$ DV for each overlapping three-year period starting with 1999-2001 and ending with 2009-2011
 - DV calculations based on EPA data handling conventions
 - Data extracted from monitors that have a non-regulatory monitoring type are omitted
 - Selection of trend sites require valid DV in 9 out of 11 three-year periods between 1999 and 2011

Trend Calculation



- Trends based on linear least squares fit to rolling three year design values (DVs)
- Negative trend indicates improving air quality
- DVs based on each 3-year period: 1999-2001, 2000-2002, ... 2009-2011
- Notes
 - On plots, DVs are for three year period ending in year shown (i.e., 2009-2011 DV plotted as 2011 value)
 - Ozone trend values expressed as ppb/year (1,000 ppb = 1 ppm); DVs are plotted as ppm

Max/Ave O₃ DVs and Trend



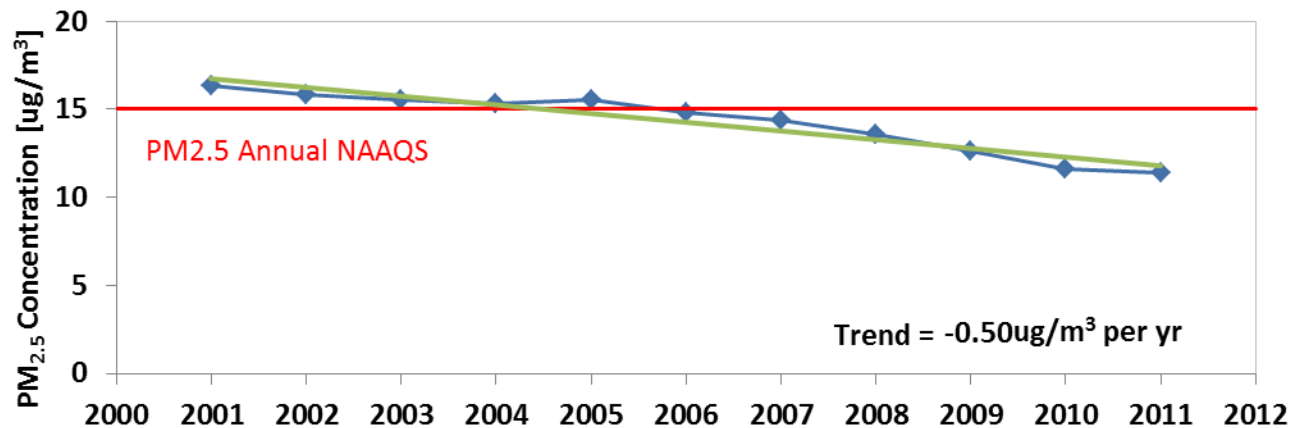
Ozone Trends by Site in New Jersey

Monitoring Sites	County	2009-2011 DV [ppm]	Trend [ppm/yr]
3400710014420101	Camden, NJ	0.08	-2.61
3401100074420101	Cumberland, NJ	0.071	-2.60
3401500024420101	Gloucester, NJ	0.082	-2.29
3401700064420101	Hudson, NJ	0.076	-1.22
3401900014420101	Hunterdon, NJ	0.077	-2.25
3402100054420101	Mercer, NJ	0.078	-2.74
3402300114420101	Middlesex, NJ	0.08	-2.35
3402500054420101	Monmouth, NJ	0.079	-1.87
3402730014420101	Morris, NJ	0.075	-2.39
3402900064420101	Ocean, NJ	0.081	-3.59
3403150014420101	Passaic, NJ	0.073	-1.64

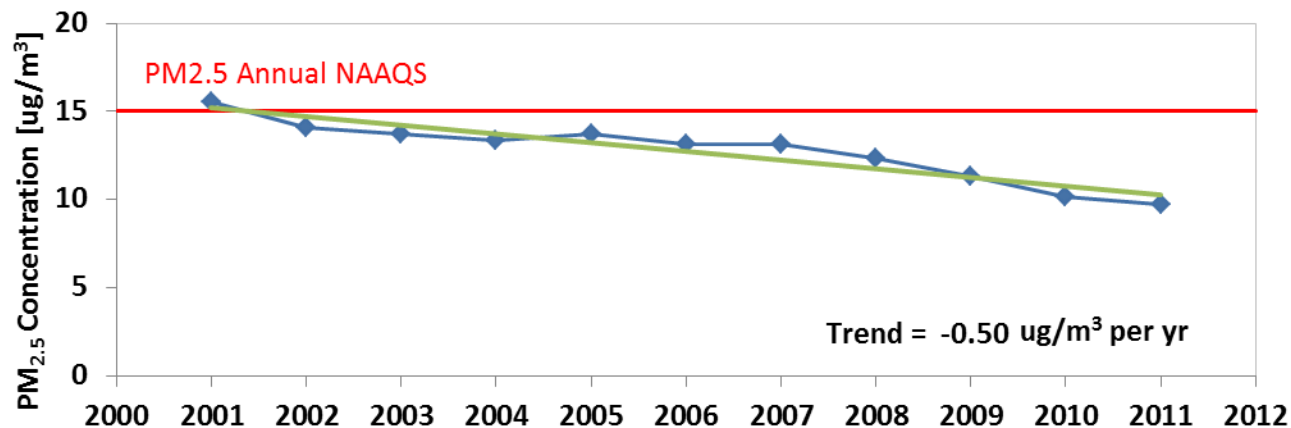
Note: Only monitoring sites meeting data completeness criteria listed

Max/Ave PM_{2.5} Annual DVs and Trend

New Jersey Max PM_{2.5} Annual Design Values

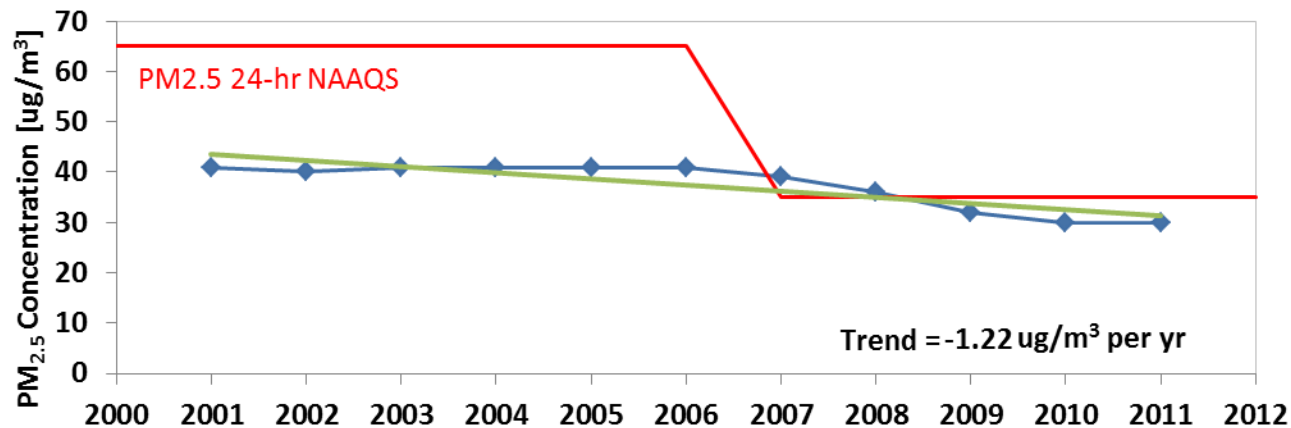


New Jersey Average PM_{2.5} Annual Design Values

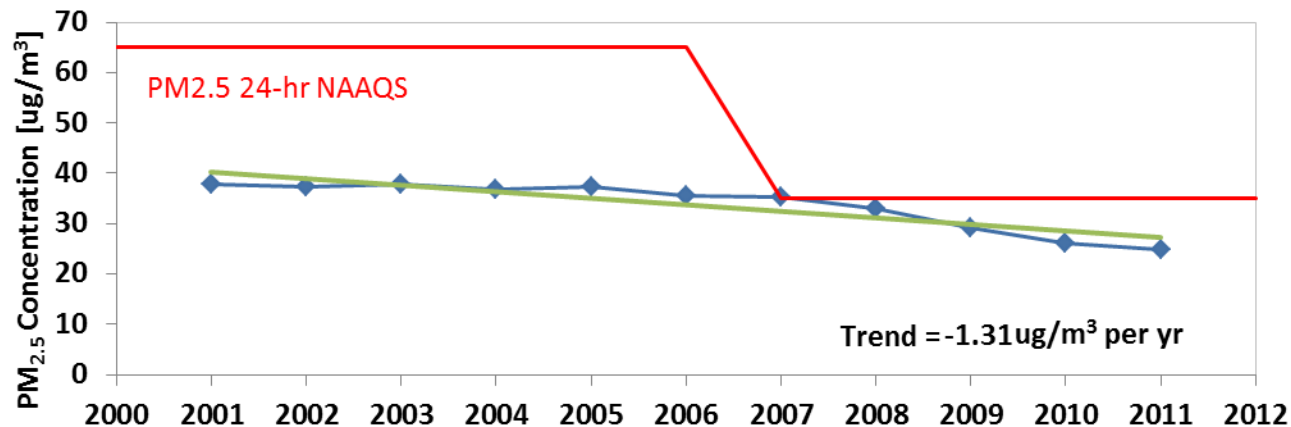


Max/Ave PM_{2.5} 24-Hour DVs and Trend

New Jersey Max PM_{2.5} 24-Hour Design Values



New Jersey Average PM_{2.5} 24-Hour Design Values



PM_{2.5} Trends by Site in New Jersey

Monitoring Site	County	2009-2011 DV [ug/m ³]		Trend [ug/m ³ per year]	
		Annual	24-Hr	Annual DV	24-Hr DV
340030003	Bergen	N/A	25	N/A	-1.00
340071007	Camden	N/A	24	N/A	-1.39
340171003	Hudson	10.3	28	-0.53	-1.24
340210008	Mercer	9.7	26	-0.47	-1.21
340230006	Middlesex	7.9	20	-0.47	-2.13
340270004	Morris	N/A	22	N/A	-1.70
340292002	Ocean	N/A	23	N/A	-1.46
340310005	Passaic	N/A	25	N/A	-1.26
340390004	Union	11.4	30	-0.50	-1.17
340390006	Union	N/A	24	N/A	-1.32
340392003	Union	9.6	N/A	-0.36	N/A
340410006	Warren	9.2	26	-0.47	-1.45

Note: Only monitoring sites meeting data completeness criteria listed

Air Quality Trends Summary

- Average O_3 and $PM_{2.5}$ design values have decreased since 1999 in New Jersey
- O_3 and $PM_{2.5}$ design values have decreased since 1999 in all currently designated O_3 and $PM_{2.5}$ non-attainment areas in New Jersey